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Original Article

Advancement and Implementation of Laparoscopic Surgery in a Tertiary Care Hospital

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ABSTRACT

Introduction: *Laparoscopic surgery, a groundbreaking minimally invasive technique, has transformed modern surgical practice by enabling procedures with smaller incisions, reduced pain, and quicker recoveries. Initially introduced for diagnostic purposes, it has evolved into a versatile therapeutic approach across various medical specialties.* ***Aim of the study:*** *The aim of the study is to evaluate the advancements and implementation of laparoscopic surgery in a tertiary care hospital of Bangladesh* ***Methods & Materials:*** *This study was conducted at the department of Surgery, Khulna Medical College Hospital, Khulna, Bangladesh, over five years, involving 122 patients who underwent laparoscopic surgery. Adult participants aged 16 and above undergoing general surgical procedures were included, excluding cases with incomplete records or severe comorbidities. Procedures were classified as basic or advanced per SAGES guidelines. Data on demographics, surgical indications, procedure types, and postoperative outcomes were analyzed using SPSS v26. Primary outcomes included the success rate of surgeries, while secondary outcomes focused on postoperative complications and 30-day mortality.* ***Result:*** *The study analyzed 122 participants' demographics, co-morbidities, surgical histories, indications for laparoscopy, and outcomes. The largest age group was 31-40 years (26.23%), and females predominated (61.48%). Diabetes was the most common co-morbidity (13.93%). Therapeutically, cholelithiasis was the leading indication (34.43%), with laparoscopic cholecystectomy being the most common procedure (33.61%). Appendicitis and laparoscopic appendicectomy followed at 28.69% and 30.33%, respectively. Complications were rare, with superficial infections most frequent. Conservative management (9.02%) was the main intervention, highlighting minimally invasive approaches. Conversion to open surgery occurred infrequently (0.82%). Advanced laparoscopic procedures and associated complications were uncommon.* ***Conclusion:*** *The study underscores the viability of laparoscopic surgery in resource-constrained environments, highlighting its safety, effectiveness, and adaptability. The successful integration of minimally invasive procedures in a tertiary care setting in Bangladesh demonstrates a transformative potential for improving surgical outcomes, emphasizing the importance of adopting advanced techniques in developing healthcare systems.*

Keywords: *Advancements, Implementation and Laparoscopic*

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INTRODUCTION

Laparoscopic surgery, often referred to as minimally invasive surgery, is a technique that has revolutionized the field of surgery by allowing surgeons to perform procedures with minimal incisions [1]. This approach not only reduces postoperative pain but also promotes quicker recovery, shorter hospital stays, and faster return to normal activities [1]. Laparoscopic surgery includes a wide variety of techniques, from diagnostic laparoscopy to complex therapeutic surgeries, and has found applications in almost all surgical specialties [2]. Initially introduced as a diagnostic tool, laparoscopy evolved into a surgical procedure following significant contributions by pioneers like Eric Muhe and Kurt Semm, who developed laparoscopic cholecystectomy and appendectomy in the late 20th century [3]. Since then, it has become a cornerstone of modern surgery, transforming the way many procedures are performed across the world. Laparoscopic surgery is still in its nascent stages, with the practice becoming more widespread in recent years, especially in tertiary healthcare institutions. Initially, the introduction of laparoscopic techniques was met with challenges, including high costs, the need for specialized training, and the lack of necessary infrastructure. Despite these obstacles, advancements in laparoscopic technology and the increasing availability of training programs have led to its gradual integration into healthcare. The adoption of laparoscopic surgery in low- and middle-income countries

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(LMICs), has been hindered by several factors, including insufficient healthcare financing, poor infrastructure, and a hierarchical surgical culture resistant to change. However, recent reports indicate that laparoscopic surgery has proven feasible in developing countries, thanks to local innovations and adaptations that reduce costs [4,5]. Globally, the adoption of laparoscopic surgery has been more rapid in developed countries where the infrastructure for advanced medical technologies is well-established. In these settings, laparoscopic surgery has become the standard of care for a variety of conditions, especially in fields like gynecology, urology, and digestive surgery [4-6]. As the technology continues to advance, new innovations, such as robot-assisted surgery and the integration of artificial intelligence and augmented reality, are further enhancing the precision and scope of laparoscopic techniques [7]. Moreover, virtual reality (VR) and robotic-assisted surgery are increasingly being incorporated into surgical curricula, offering new avenues for enhancing surgical performance in both high- and low-resource settings [8]. These advancements are making laparoscopic surgery even more effective and accessible, particularly in complex and high-risk cases [7,9,10]. On the international stage, laparoscopic surgery is considered a routine practice in most developed nations, with laparoscopic cholecystectomy, appendectomy, and hernia repair being some of the most common procedures performed [11]. Over the past few decades, the widespread use of laparoscopy has significantly reduced patient recovery times and improved surgical outcomes [12]. However, while the technique is widely adopted in many countries, its practice is not as common in LMICs due to various socioeconomic and technical barriers. Despite these challenges, there have been increasing efforts to train surgeons in laparoscopic techniques through workshops, fellowships, and simulation-based training, helping to bridge the gap between high-income and low-income countries [13,14]. The aim of the study is to evaluate the advancements and implementation of laparoscopic surgery in a tertiary care hospital of Bangladesh.

METHODOLOGY & MATERIALS

This prospective observational study conducted the department of Surgery, Khulna Medical College Hospital, Khulna, Bangladesh. The study duration was five years from January 2019 to December 2023. During the study period a total of 122 consecutive patients who underwent laparoscopic surgery at our hospital women who were enrolled and analyzed.

Inclusion Criteria:

- Adult patients with aged 16 and above.
- Participants who underwent general surgical procedures.

Exclusion Criteria

- Patients with missing or incomplete medical records.
- Patients with severe comorbidities.

Laparoscopic Procedure

Laparoscopic procedures were categorized into basic and advanced based on the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) classification [15]. Basic procedures included laparoscopic cholecystectomy, appendectomy, and diagnostic laparoscopy, while more complex surgeries were categorized as advanced laparoscopic procedures.

Data Collection Procedure

Patient demographic details, indications for laparoscopic surgery, types of procedures, and postoperative complications were extracted from the hospital's medical records. The primary outcome measure was the success rate of laparoscopic surgery, while secondary outcomes included postoperative morbidity and 30-day postoperative mortality. Consent was obtained from all patients, and they were informed of the potential for conversion to open surgery in challenging intraoperative scenarios. Ethical approval for the study was granted by the hospital's Ethical Review Committee.

Data Analysis

All data were presented in a suitable tables and graph according to their affinity. A description of each table and graph was given to understand them clearly. Data were analyzed using SPSS v 26. Descriptive statistics were presented as means and standard deviations (for normally distributed data), medians and interquartile ranges (for non-normally distributed data), or number and percentages (for categorical data).

RESULT

Table I presents the demographic characteristics of a study population consisting of 122 participants. The age distribution reveals that the largest age group is 31-40 years (26.23%), followed by 22.13% from 21-30 years and 17.21% aged 41-50 years, respectively. Regarding gender, females are more prevalent, representing 61.48% of the population, while males account for 38.52%. Among the medical co-morbidities, diabetes was the most prevalent, affecting 17(13.93%) participants, followed by hypertension in 8(6.56%) participants. Hemoglobinopathy (HBSS) and asthma were present in 6(4.92%) and 5(4.10%) participants, respectively, while three individuals (2.46%) had both diabetes and hypertension. Regarding previous abdominal surgeries, 5(4.10%) participants had undergone a cesarean section, 3(2.46%) had an appendicectomy, and 2(1.64%) each had incisional herniorrhaphy, laparotomy for an abdominal mass, and myomectomy (Table II). For diagnostic purposes, the most common indication was laparoscopy with or without biopsy of intraabdominal tumors (10.66%). Other diagnostic indications included penetrating abdominal trauma (3.28%), chronic pelvic pain (2.46%), blunt abdominal trauma (0.82%), and intestinal malrotation (0.82%). Therapeutically, the most frequent indication was cholelithiasis, which represented 34.43% (42 cases) of the surgeries. This was followed by appendicitis at 28.69% (35 cases). Laparoscopic adhesiolysis was performed in 6.56% (8 cases), while intra-abdominal abscesses and hernias (inguinal and ventral) each accounted

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for 2.46% (3 cases) of the procedures (Table III). Basic laparoscopic procedures constituted the majority, with laparoscopic cholecystectomy being the most common at 33.61% (41 cases), followed by laparoscopic appendicectomy at 30.33% (37 cases). Diagnostic laparoscopies for intestinal malrotation, masses, and ascites accounted for 9.02% (11 cases), while those for trauma and chronic pelvic pain were less frequent at 2.46% (3 cases) and 1.64% (2 cases), respectively. Advanced laparoscopic procedures included laparoscopic adhesiolysis for adhesions at 4.92% (6 cases) and laparoscopic adhesiolysis with drainage of the liver or peri-hepatic abscess at 3.28% (4 cases). Other advanced procedures, like the intraperitoneal placement of mesh for ventral hernias, were performed in 1.64% (2 cases). Conversion to open procedures was rare, each occurring in 0.82% (1 case) of laparoscopic adhesiolysis, cholecystectomy, appendicectomy, and transabdominal preperitoneal (TAPP) surgeries (Table IV). For cholecystectomy, the most frequent complications were superficial surgical site infections (2.46%), followed by port site hernias and hypertrophic scars, each occurring in 1.64% of cases, and duodenal injury, which was the least common at 0.82%. In contrast, appendicectomy complications included superficial surgical site infections in 4.92% of cases, which was the highest incidence for this procedure, and pelvic abscess in 0.82% of cases (Table V). The most common intervention is conservative management, which is utilized in 9.02% of cases. This is followed by suture repair, employed in 1.64% of cases. Open re-exploration and repair, open re-exploration and drainage, and blood transfusion are each used in 0.82% of cases, showing that these more invasive or intensive interventions are relatively rare compared to conservative approaches (Figure 1).

Table – I: Demographic characteristics of the study population (*n*=122)

Variables	Frequency (n)	Percentage (%)
Age (years)		
≤20	14	11.48
21-30	27	22.13
31-40	32	26.23
41-50	21	17.21
51-60	16	13.11
>60	12	9.84
Mean±SD	37.71±4.59	
Gender		
Male	47	38.52
Female	75	61.48

Table – II: Clinical characteristics of the study population (*n*=122)

Variables	Frequency (n)	Percentage (%)
Medical co-morbidity		
Diabetes	17	13.93
Hypertension	8	6.56
Hemoglobinopathy (HBSS)	6	4.92
Asthmatic	5	4.10
Diabetic-Hypertensive	3	2.46
Previous abdominal surgery		
Caesarean section	5	4.10
Appendicectomy	3	2.46
Incisional herniorrhaphy	2	1.64
Laparotomy for abdominal mass	2	1.64
Myomectomy	2	1.64

Table – III: Indications for laparoscopic surgery among study participants (*n*=122)

Variables	Frequency (n)	Percentage (%)
Diagnostic indications		
Diagnostic laparoscopy +/- biopsy of Intraabdominal tumors	13	10.66
Diagnostic laparoscopy for Penetrating abdominal trauma	4	3.28
Diagnostic laparoscopy for chronic pelvic pain	3	2.46
Diagnostic laparoscopy for blunt abdominal trauma	1	0.82
Diagnostic laparoscopy for intestinal malrotation	1	0.82
Therapeutic indications		
Cholelithiasis	42	34.43
Appendicitis	35	28.69
Laparoscopic adhesiolysis	8	6.56
Intra-abdominal (Liver/peri-hepatic) abscess	3	2.46
Hernias (Inguinal and Ventral)	3	2.46

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Table – IV: Completion rates of laparoscopic procedures and conversion to open surgery (*n*=122)

Variables	Frequency (n)	Percentage (%)
Basic Laparoscopy		
Laparoscopic cholecystectomy	41	33.61
Laparoscopic appendicectomy	37	30.33
Diagnostic laparoscopy for intestinal malrotation, masses, ascites +/-biopsy	11	9.02
Diagnostic laparoscopy for trauma (blunt and penetrating)	3	2.46
Diagnostic laparoscopy for chronic pelvic pain	2	1.64
Advanced laparoscopy		
Laparoscopic adhesiolysis for adhesions	6	4.92
Laparoscopic adhesiolysis and drainage of liver/peri-hepatic abscess	4	3.28
Laparoscopic intraperitoneal placement of mesh for ventral hernias	2	1.64
Intraoperative conversions to open procedure		
Laparoscopic adhesiolysis	1	0.82
Laparoscopic cholecystectomy	1	0.82
Laparoscopic appendicectomy	1	0.82
Laparoscopic TAPP	1	0.82

Table – V: Incidence of procedure-related postoperative complications among study participants (*n*=122)

Variables	Frequency (n)	Percentage (%)
Cholecystectomy		
Superficial surgical site infection	3	2.46
Port site hernia	2	1.64
Hypertrophic scar	2	1.64
Duodenal injury	1	0.82
Appendicectomy		
Superficial surgical site infection	6	4.92
Pelvic abscess	1	0.82

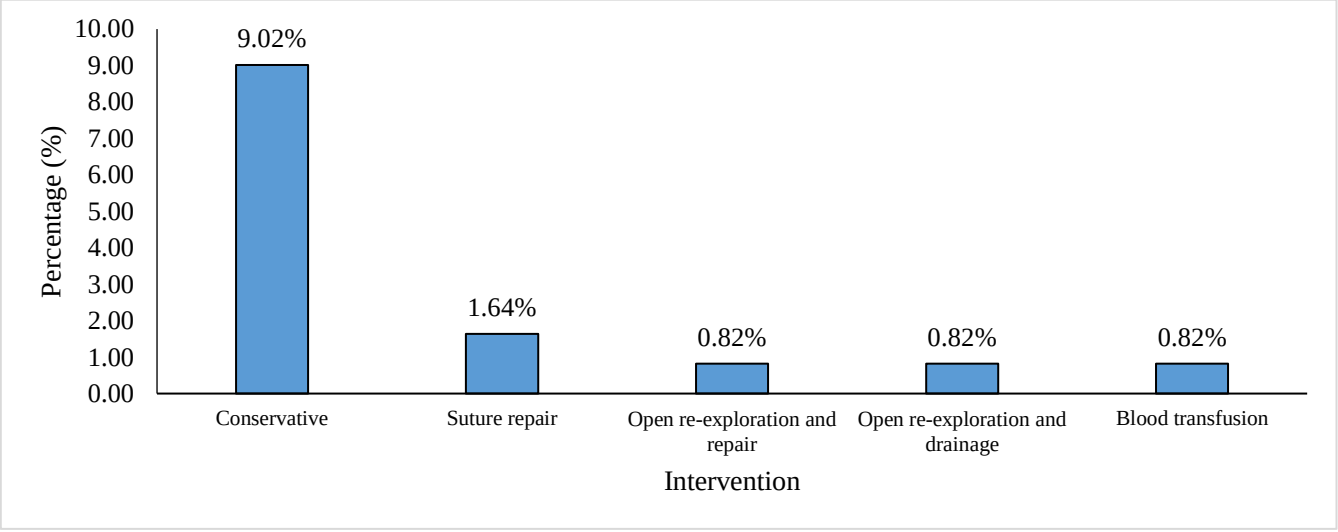

Figure – 1: Procedure-related postoperative interventions (*n*=122)

DISCUSSION

Laparoscopic surgery has revolutionized the field of surgery by offering reduced postoperative pain, shorter hospital stays, faster recovery times, and improved outcomes compared to traditional open procedures. These advancements have profoundly impacted surgical practices globally, particularly in developing countries where healthcare systems are gradually introducing modern technologies. In Bangladesh, despite challenges such as limited resources, inadequate training, and high equipment costs, the growing adoption of laparoscopic techniques underscores a commitment to improving surgical care. This study aims to explore the advancements and implementation of laparoscopic surgery in a tertiary care hospital in Bangladesh, focusing on demographic characteristics, clinical indications, procedural outcomes, and associated challenges. By assessing the effectiveness and limitations of laparoscopic procedures in this context, the study seeks to contribute to the broader

discourse on enhancing surgical care in resource-limited settings. The study population was predominantly composed of females (61.48%), and the mean age was 37.71 ± 4.59 years, indicating a relatively young adult cohort. Similar finding has been reported by other laparoscopic surgeons [16-19]. The most common co-morbidity observed was diabetes (13.93%), followed by hypertension (6.56%), which aligns with the global burden of non-communicable diseases in similar demographic settings [20,21]. Notably, previous abdominal surgeries were infrequent, with Caesarean sections accounting for 4.10%. This low frequency of prior surgeries may reflect the limited surgical history among the population or the cautious selection of laparoscopic candidates to minimize complications related to adhesions. In this present study, therapeutic indications dominated (72.95%), with the most common being cholelithiasis (34.43%) and appendicitis (28.69%). The spectrum of cases in our initial experience was akin to those documented in the pilot experience of other health institutions in laparoscopy in other developing country [17,22]. Diagnostic indications were less frequent (27.05%) but crucial in managing intra-abdominal tumors (10.66%) and trauma cases. In the last few years, laparoscopic surgery has been applied in the diagnosis and therapeutic management of hemodynamically stable patients with abdominal injuries [23]. Laparoscopic interventions in abdominal trauma have helped to reduce the negative laparotomy rate [24-26]. Mohammed et al reported that laparoscopy was useful in avoiding laparotomy in 53 (81.5%) patients with abdominal trauma [27]. Laparoscopic cholecystectomy (33.61%) and appendicectomy (30.33%) were the most frequently performed procedures. Laparoscopic adhesiolysis for symptomatic (pain and partial intestinal obstruction) intestinal adhesions was performed in 6 (4.92%) patients in this study. In selected patients, the safety of laparoscopy for the treatment of patients with chronic abdominal pain and or recurrent bowel obstruction has been established [24]. The high completion rate of laparoscopic procedures is commendable, with conversions to open surgery being rare (3.28%). Most available series on laparoscopy reported a conversion rate of less than 5% [16,17,22]. Conversion rate in this study approximates that reported by Ekwunife and Misauno [16,22,28]. Conversions from laparoscopic to open surgery in this study occurred in 4 patients due to uncontrollable hemorrhage, dense adhesions, cardiac arrhythmias, appendiceal mass, and bladder injury. The most common procedure-related complication in this study was superficial surgical site infections in 6 (4.92%) patients following laparoscopic appendicectomy. This is slightly less than 6.4% reported by Adisa et al. [27]. The incidence of surgical site infection after laparoscopic appendicectomy was estimated to be between 2.8% and 12.8% in a larger volume series [28]. The results from procedure-related postoperative interventions of our study were similar to another study, where the most common intervention included conservative [29].

Limitations of the study:

- The low number of advanced laparoscopic surgeries performed restricts the evaluation of their feasibility and outcomes.
- Lack of detailed cost analysis and access to advanced laparoscopic equipment may not reflect the true potential of the technique in other settings.

CONCLUSION

This study highlights the successful implementation of laparoscopic surgery in a tertiary care hospital in Bangladesh, demonstrating its safety, effectiveness, and applicability in a resource-limited setting. Therapeutic laparoscopic procedures, particularly cholecystectomy and appendicectomy, were the most frequently performed, with low conversion and complication rates, indicating the feasibility of adopting minimally invasive techniques in similar contexts. Despite challenges, the integration of advanced laparoscopic procedures showcases the potential for expanding surgical care in developing regions, paving the way for improved patient outcomes and reduced morbidity.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee.

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